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A PROCEDURE FOR USING POLYCHAETE ANNELIDS FOR ENVIRONMENTAL MON--ETC(U)

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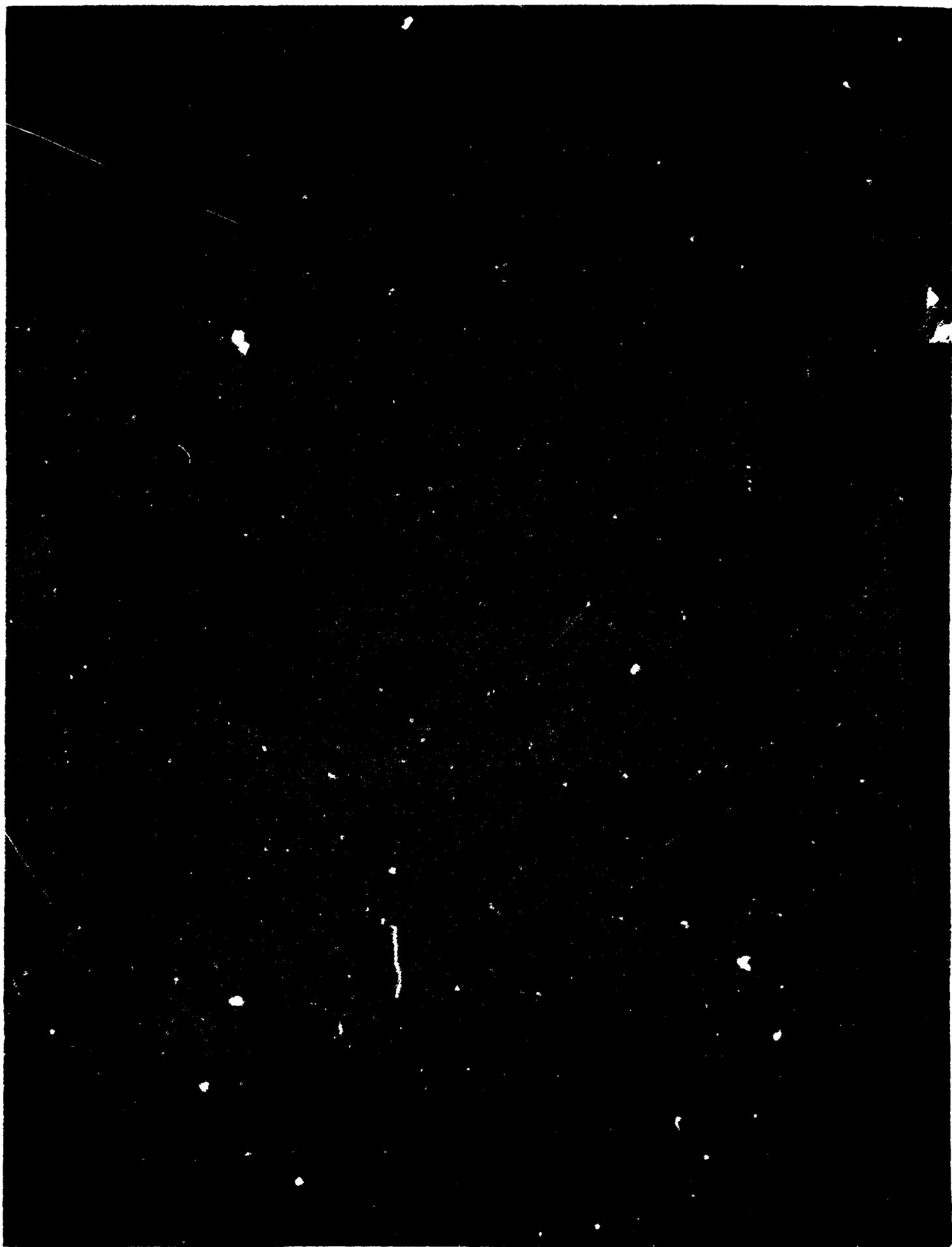
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## DEVELOPMENT OF A POLYCHAETE ASSEMBLAGE CHARACTERIZATION (PAC) PROCEDURE

## INTRODUCTION

Polychaete annelid worms typically comprise a dominant element of the macrobenthic infaunal communities of nearshore marine waters.<sup>1</sup> Polychaetes have also been shown to respond to environmental degradation or other change in environmental conditions through changes in their kinds, number, and distribution in an affected location.<sup>2</sup> Thus, if it were feasible to establish a set of average characteristics of the polychaete assemblage of a given habitat or locality under average conditions, then one should be able to detect environmental changes there through changes observed in those characteristics. The nature of the observed change in polychaete assemblage might also indicate the kind and degree of environmental shift involved.

The potential usefulness of such polychaete assemblage characterizations for environmental assessment and monitoring of nearshore waters is self evident. Once established by field studies, the Polychaete Assemblage Characterization (PAC) of a given habitat or locality would serve as a base datum from which to identify and measure stability or change there in the face of natural or man-induced environmental activity over time.

Polychaete sampling studies typically produce lengthy lists of species and number which may vary markedly from station to station or date to date in the same locations. The majority of species encountered are occasional to rare in occurrence, while relatively few species usually comprise the great majority of individuals present. Thus, numerous polychaete samples would have to be taken over an extended period of time in order to obtain an assemblage characterization that is meaningfully average and parameters that would reduce the data to manageable and useful dimensions.

During a survey conducted by the Naval Coastal Systems Center along the Gulf beach at Mexico Beach, Florida, bottom substrate samples were collected at 10 stations in August 1973, April, May, and August 1974, and April and August 1975, and their polychaete fauna (and other macrobenthic

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<sup>1</sup>Day, H. J., 1967, "A Monograph on the Polychaeta of Southern Africa, Part 1, Errantia," Trustees of the British Museum (Natural History), London.

<sup>2</sup>Dauer, D. M. and Conner, W. G., 1980, "Effects of Moderate Sewage Input on Benthic Polychaete Populations," *Estuar. and Mar. Sci.*, 10:344-346.



organisms) collected, preserved, and identified. These large and numerous polychaete collections, made over 24 months, provided an excellent opportunity to examine the feasibility of developing a Polychaete Assemblage Characterization procedure. This paper reports the results of analysis of these polychaete data toward that end. It should be noted that the results offered represent the final product of numerous tentative attempts at sorting and quantifying the polychaete data, most of which proved too cumbersome, too general, or simply too unrewarding for present purposes.

#### MEXICO BEACH STUDY AREA AND SAMPLING STATIONS

The polychaete collections involved were part of a study of physical, chemical, and biological conditions occurring near a small man-made inlet at Mexico Beach before, during, and after the operation of an experimental jet pump sand transfer system being tested there by engineers of the US Army Corps of Engineers Waterway Experiment Station (WES), Vicksburg, Mississippi. Salsman et al describe the area and present findings on the physical environment during the study period.<sup>3</sup> The biological samples were collected to assess what, if any, effect the WES pumping experiment might have had on the bottom fauna of the area. Analysis of the data station by station and date by date failed to show significant differences in polychaete kind, numbers, or distribution before, during, and after the WES tests (Loftin and Tuovila, 1980, MS in files of Environmental Sciences Division, NCSC).

Mexico Beach lies some 56 kilometres (35 miles) southeast of Panama City, Florida, along the open Gulf of Mexico. Landward, there is a narrow sandy beach backed by low dunes and pine flatlands (and a small urban development east of the inlet). At the center of the test site is a man-made inlet, about 18 metres (60 feet) wide and 1.2 metres (4 feet) deep, which discharges a very small volume of fresh water and sediment, mostly fines in suspension or solution.<sup>3</sup> Tides and currents here are generally weak and wave action is moderate. Seaward, a shallow sand bar about 0.6 metre (2 feet) deep parallels the beach some 61 to 122 metres (200 to 400 feet) from shore. The bar drops off rapidly to about 4.6 to 6.1 metres (15 to 20 feet) deep. From there, the bottom slopes off very gradually, only attaining the 9-metre (30-foot) contour some 9.6 kilometres (6 miles) off the beach. (This is in sharp contrast with the more steeply sloping bottom off Panama City Beach, which attains the 9-metre (30-foot) contour only 400 metres (one-fourth mile) off shore.)

For bottom sampling, five stations were established at or near the shoreward base of the sandbar (the inner stations) at about 1.5 metres (5 foot) depth and five near the seaward base of the sandbar (the outer stations) at about 3.7 metres (12 foot) depth. Four of the inner and outer

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<sup>3</sup>Naval Coastal Systems Laboratory Letter Report, "Physical Environmental Conditions at the WES Jet Pump Test Site in Mexico Beach, Florida," by G. G. Salsman, August 1975, UNCLASSIFIED.



stations were located near the small inlet (the Inlet Inner Habitat and the Inlet Outer Habitat). The remaining stations, located some 1.5 kilometres (500 feet) west of the inlet, constituted the Beach Inner Habitat and Beach Outer Habitat.

It was assumed that environmental conditions particular to the inner and outer stations, and their inlet and open beach positions should result in polychaete assemblages that differed one from the other in each of the four locations, or habitats, samples. If so, the Polychaete Assemblage Characterizations (PACs) developed for each of these habitats should differ and indicate broadly the degree of environmental distinctiveness of the habitats one from the other.

#### SAMPLING PROCEDURE

One day's sampling was carried out at all sampling locations in August 1972, April, May, and August 1974, and April and August 1975. Samples were taken using a hand-held suction apparatus operated by scuba diver. The apparatus samples a bottom area of 615 centimetres<sup>2</sup> to a depth of 10 centimetres. Fifteen such samples were taken at each station on each sampling date. The samples were individually bagged, labelled, and preserved with 10 percent formalin in the field. In the laboratory, the sand samples were sifted and the polychaetes (and other macrofauna) removed, preserved, and labelled.

The polychaetes collected were identified to species and counted in the laboratories of Dr. Henry Kritzler, Florida State University, and Dr. Jack Taylor, Panama City, Florida. These data were computerized at NCSC in a program for the Hewlett-Packard (HP) 9830A programmable calculator. Statistical analysis revealed that 10 samples of the 15 taken would yield approximately 71 percent of expected species present. Therefore, for convenience, the first 10 samples at each station and date were combined and treated as a sample unit in further data analysis, and the other five samples disregarded. Species and numbers of polychaetes from each habitat on each sampling date are presented in Appendix A.

#### PAC PROCEDURE

Polychaete data from the four separate stations of the Inlet Inner and Inlet Outer Habitats, respectively, were examined separately and then pooled for each sampling date; there was only a single station involved per sampling date for the Beach Inner and Beach Outer Habitats, respectively. Community parameters of richness, density, and diversity were then determined for each of the four habitats for each sampling date and the average value for each parameter calculated. In addition, the parameter values for all dates combined were determined for each habitat. Further, a list of major polychaete species (genera, families) for each habitat was prepared using criteria detailed below. These parameter values and lists comprise the Polychaete Assemblage Characterization (PAC) for each habitat examined.



The PACs were prepared at three taxonomic levels; i.e., species, genus, and family. Identification of polychaetes to species is time consuming, costly, and requires a high degree of expertise for accuracy. Further, a species-level PAC would tend to be highly local as an environmental indicator. If genus- or family-level PACs can provide essentially the same summary information at a similar level of accuracy, then their use would result in faster, less costly PAC procedures. Identifications could be carried out by technicians and more locations sampled more often with the same resources. Information derived from these higher taxa should be more readily comparable with data collected from other geographic locations and thus be of more general application.

As used in this initial study, the PAC parameters involved are defined as follows:

1. Richness. The number of different species (genera, families) present in a sample or set of samples.

2. Density. The number of individual polychaete worms in a unit area of sampled substrate; in this case, the number of individuals per 1.0 metre<sup>2</sup> of substrate.

3. Diversity. The Shannon-Wiener species diversity index value ( $H'$ ) of a sample or set of samples. (Genus and family counts, respectively, are used in place of the usual species counts when those taxa are being considered.)

4. Major Forms (Species, Genera, Families). Biotic communities and assemblages typically are comprised of certain frequently occurring taxa, usually present in high to moderate density, tailing off to less common to rare forms of lesser density. The most frequently occurring and numerous forms, i.e., major species (genera, families), should make up a grouping characteristic of the assemblage involved.

In this analysis, lists of major forms were constructed using the following criteria: a major species (genus, family) is one which (a) comprises at least 2 percent of the total number of individual polychaetes in the pooled samples of all sampling dates for a habitat and (b) occurs on more than 50 percent of the sampling dates at the habitat. Major forms may be further subdivided as follows:

1. Dominant. In relatively high numbers (10 percent or more of the total number of individual polychaetes in a set of pooled samples) and with at least 2 percent of total individuals present on each of more than two-thirds of the sampling dates involved.

2. Abundant. With at least 2 percent of the total individuals present on each of more than one-half of the sampling dates involved.

3. Common. With at least 2 percent of the total individuals present on each of one-half or less of the sampling dates involved.



Detailed steps of PAC determination are presented in Appendix B.

## RESULTS

### Species-Level PACs

Table 1a presents species-level PACs developed for the four habitats sampled in the Mexico Beach area.

Inspection of Table 1a shows four relatively different PACs--averages of averages--for the locations under study, indicating that each habitat supports a fairly distinctive polychaete assemblage.

1. Richness. The Inlet and Beach Outer Habitats are most alike for this parameter with 44 and 34 species present on average per sampling date and 108 and 99 species present over all sampling dates, respectively. The Inlet Inner Habitat has a richness nearly twice that of the Beach Inner Habitat but only about half that of the Inlet and Beach Outer Habitats.

2. Density. The average number of individual polychaetes per square metre of sampled substrate is notably different at each habitat. The two inlet habitats have the greatest density, while the beach habitats both have much lower densities and the Beach Inner area least of all.

3. Diversity. The Inlet Inner and Outer Habitat diversities are quite similar, with an average moderate diversity index of 2.8 and a total high diversity index of about 3.5. The Beach Inner and Outer Habitats have diversities at extremes, with average diversities of 2.1 and 3.1, and total diversities of 2.8 and 4.3, respectively.

4. Major Species. A salient feature of the major species lists is the dominant position of Microphthalmus scelkowi on the Beach Inner Habitat, comprising 38 percent of all individuals there. This species is abundant in the Inlet Inner Habitat but only common or absent on the major forms list in the Inlet and Beach Outer Habitats, respectively. On the other hand, Onuphis eremita is dominant in all areas except the Beach Inner Habitat.

In summary, the Beach Inner Habitat appears to be the most distinct of the four areas examined with lowest richness, density, and diversity and a unique dominant species. In contrast, the Inlet Inner Habitat has moderately high richness, density, and diversity with no notable major forms distribution. The Inlet and Beach Outer Habitats differ principally in the greater density of the former and diversity of the latter.

These PACs have defined average polychaete assemblages from four separate but nearby localities showing moderate to large differences among the assemblages and suggesting contrasting environmental conditions at each of the four habitats. The PACs, then, indicate probable environmental



TABLE 1a  
SPECIES-LEVEL PACS OF FOUR HABITATS AT MEXICO BEACH

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Richness*	20/53	11/30	44/108	34/99
Density <sup>+</sup>	484	172	725	277
Diversity <sup>o</sup>	2.77/3.53	2.10/2.77	2.74/3.77	3.12/4.32
Major Species**				
<i>Pareulepis fimbriata</i>				C/.03
<i>Nephtys buccera</i>	A/.06	A/.04		A/.13
<i>Nephtys picta</i>			C/.04	C/.02
<i>Microphthalmus scelkowi</i>	A/.13	D/.38	C/.04	
<i>Armandia agilis</i>	C/.18		C/.16	C/.27
<i>Dispio uncinata</i>		C/.03		
<i>Scolecipis squamata</i>	A/.07			
<i>Spiophanes bombyx</i>	C/.03		A/.09	A/.09
<i>Paraonis fulgens</i>	A/.05	A/.06		
<i>Onuphis eremita</i>	D/.22	A/.07	D/.31	D/.15
<i>Magelona riojai</i>	A/.06	C/.03	A/.11	C/.05
<i>Lumbrineris</i> sp.				C/.04

\* The number of species present per sample; here, e.g., with 20/53, "20" is average number of species present per sampling date, "53" the total number of species for all dates pooled.

+ The average number of individual polychaete worms per 1.0 m<sup>2</sup> of substrate sampled from pooled samples.

<sup>o</sup> The Shannon-Wiener Diversity Index value (H'); here, e.g., with 2.77/3.53 "2.77" is the average diversity per sampling date, "3.53" is the diversity calculated for all dates pooled.

\*\* Species comprising at least two percent of total individual worms in pooled samples and present on more than half of sampling dates. D, A, and C represent "dominant," "abundant," and "common," respectively. Numbers represent the proportion of total individual worms (1.00) comprised by this species.



differences there. They do not, of course, identify the nature or source of the differences. In the present situation, it would seem reasonable to suppose that the inner stations differ from the outer stations principally in effects due to shallow water and turbulence, the outer from the inner stations in greater depth and more stable conditions, and the two inlet habitats from the beach habitats by beneficial and adverse contributions from the man-made inlet. So, while the PACs do not provide the answers, they do suggest where and how environmental investigation should be directed.

The polychaete data used to develop the PACs involved 10 stations at which 10 samples of 615 centimetres<sup>2</sup> of substrate were collected on each of six occasions. Thus, a total of 369,000 centimetres<sup>2</sup> (36.9 metres<sup>2</sup>) of substrate was examined from which 23,686 polychaete worms of 139 species were collected, identified, and analyzed. The PACs have reduced this massive amount of data into comprehensible summaries of polychaete occurrence and pattern in the four habitats examined, defining the average polychaete assemblage found in each and demonstrating distinctions among them.

#### Genus-Level PACs

Table 1b presents genus-level PACs for the four Mexico Beach habitats. Comparing this table with Table 1a, little difference can be seen between the genus- and species-level PACs. There is uniform numerical reduction in richness and diversity, reflecting the smaller number of genera over species. However, essentially the same ratios of richness and density between habitats exist at the genus level as at the species level. The lists of major forms likewise remain quite comparable. In a few cases, e.g., Nephtys, the combining of species results in changes from common to abundant. It is likely that the appearance of the genera Lumbrineris and Prionospio in the Beach and Inlet Outer Habitat lists does indicate genera partial to deeper water areas not reflected in the species-level lists.

Thus, the genus-level PACs furnished much the same summary information on polychaete assemblages of the four habitats as did the species-level PACs, with little apparent loss of useful definition. Given the significant logistic advantages of identifying polychaete collections to genus rather than to species, and in view of the comparable results obtained, further PAC development and use should probably be concentrated at the genus level. Species-level PACs should be made on a sampling basis to verify comparability of these two levels of PACs in other habitats and localities.

#### Family-Level PACs

Table 1c presents family-level PACs for the four Mexico Beach habitats. Comparison of the family-level PACs with those by species (Table 1a) and genus (Table 1b) shows a general lowering of richness and diversity values due to the smaller number of units involved at the family level. However, ratios of the parameter values between the four habitats



TABLE 1b  
GENUS-LEVEL PACs OF FOUR HABITATS AT MEXICO BEACH\*

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Richness	16/33	10/24	36/72	28/62
Density	484	172	725	277
Diversity	2.58/3.29	2.08/2.67	2.64/3.53	2.98/3.93
Major Genera				
Pareulepis				C/.03
Nephtys	A/.07	A/.06	A/.05	A/.04
Microphthalmus	A/.17	D/.38	C/.04	
Armandia	C/.18	C/.27	A/.17	C/.28
Dispio		C/.03		
Prionospio			C/.02	A/.06
Scoelelepis	A/.07			
Spio	C/.02			
Spiophanes	C/.03		A/.09	A/.09
Paraonis				
Onuphis	D/.22	A/.07	D/.31	D/.15
Magelona	A/.06	C/.03	A/.11	A/.06
Lumbrineris			C/.02	A/.05

\* Consult Table 1a for explanation of parameters and values; substitute "genus" for "species"



TABLE 1c  
FAMILY-LEVEL PACs OF FOUR HABITATS AT MEXICO BEACH\*

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Richness	12/17	8/14	22/30	19/30
Density	484	172	725	277
Diversity	2.34/2.86	1.91/2.50	2.36/3.16	2.56/3.28
Major Families				
Eulephtidae	A/.07	A/.05	A/.05	C/.03
Nephtyidae	C/.02		C/.03	A/.05
Syllidae	A/.17	D/.38	C/.04	
Hesionidae				A/.06
Capitellidae				C/.30
Opheliidae	C/.18	C/.27	D/.18	D/.19
Spionidae	D/.19	A/.09	D/.14	
Paraonidae	A/.05	C/.06		D/.15
Onuphiidae	D/.22	A/.07	D/.31	A/.06
Lumbrineridae			C/.02	A/.06
Magelonidae	A/.06	A/.03	A/.12	
Orbinidae	A/.02			C/.02
Cirratulidae				

\*Consult Table 1a for explanation of parameters and values; substitute "family" for "species" as appropriate.



remain essentially the same as for the species and genus; i.e., the same kinds and degrees of likeness and differences are seen at all three levels.

The lists of major forms provide perhaps the most interesting and useful aspect of family-level PACs. There is, of course, loss of detail as specific and generic identities are buried in the family categories. However, this combining into families brings several species and genera, individually not notable, into prominence. For example, Spionidae appeared as a dominant family in three of the habitats and abundant in the fourth. Individual species or genera of spionids (i.e., Scoelelepis, Spio, Spiophanes, Dispio, Prionospio) appear irregularly on the major lists of the different habitats, none as dominant. This family, containing the greatest number of species of the families found in this study, now takes a position of importance otherwise obscured in the PACs.

Examining Table 1c further, two major families in the Beach Outer Habitat (Capitellidae, Cirratulidae) are not represented in the species or genus lists and a third (Eulephtidae) only in the Beach Outer Habitat lists. It appears likely that these three families, low numerically as species or genera, are collectively important in and perhaps diagnostic of that habitat and its particular set of environmental conditions.

In general, members of the same family of polychaetes (or other organisms) have broadly similar niches in an environment and thus require similar conditions and resources. As that set of conditions and resources is abundant or limited, so will representatives of that family be relatively abundant or limited in that habitat or locality. Thus, family-level PACs may provide an important level of information on polychaete assemblages and associated environmental factors not so apparent from PACs of lower taxa. Since family-level PACs can readily be developed from data used for species- or genus-level PACs, it is recommended that PACs by family be prepared routinely in subsequent investigations of this procedure with special emphasis on the lists of major families and their interpretation.

## CONCLUSIONS

Based on this initial effort, the Polychaete Assemblage Characterization (PAC) procedure outlined and examined in this report appears to be a promising approach toward a simple, accurate, and useful tool for environmental assessment and monitoring of nearshore marine waters. In further field work and analysis, emphasis should be placed on PACs at the genus-level, with species-level PACs conducted on a sampling basis as a check. Family-level PACs are readily obtained from data developed for genus-level PACs and they should be routinely prepared with emphasis on lists of major families and their interpretation.



## PACS OF PANAMA CITY BEACH HABITATS

## INTRODUCTION

Mexico Beach (locale of the WES pumping studies) and Panama City Beach lie along the Gulf of Mexico about 48 kilometres (30 miles) apart. On shore, both appear much the same with a gradually sloping sandy beach and low foredunes. The surf along the Mexico Beach area seems relatively quieter than that of Panama City Beach. This is indeed the case, reflecting significant differences in the seaward slopes of the bottoms and degree of exposure to the open Gulf. Mexico Beach is semi-enclosed on a bend of the coast between St. Andrew Point to the west and St. Joseph Point to the southeast. The 9-metre (30-foot) bottom contour occurs some 11 kilometres (6 nautical miles) off Mexico Beach. The Panama City Beach area, on the other hand, runs straight along the open Gulf, with the 9-metre (30-foot) contour within about 400 metres (one-fourth mile) of the shore. One and six-tenths kilometres (1 mile) off shore at Panama City Beach depths range from 15 to 18 metres (50 to 60 feet). At Mexico Beach, similar depths begin 16 kilometres (10 miles) off shore.

For these reasons alone, one would expect near-shore environmental conditions to be different in the two localities. If so, then there should be differences in the infauna of their comparable bottom zones. Polychaete Assemblage Characteristics (PACs) of those zones should demonstrate such differences, if any, and provide a rough measure of the degrees of difference.

Saloman<sup>4</sup> took bottom samples and collected and identified their benthic organisms, including polychaetes, from six parallel rows of stations at different distances from shore in the Panama City Beach area quarterly from November 1974 through August 1975. His data have been used here to develop PACs of the six habitats (rows of stations) involved in his Panama City Beach investigations.

## PROCEDURES

The Panama City Beach sampling area lies between the entrance to St. Andrew Bay (West Pass) near Panama City and Phillip's Inlet, some 30 kilometres (18.5 miles) to the west. Saloman sampled along six rows of stations paralleling the shore (considered here as habitats), as follows:

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<sup>4</sup>US Army COE Coastal Engineering Research Center Misc. Report No. 76-10, "The Benthic Fauna and Sediments of the Nearshore Zone Off Panama City Beach, Florida," by C. H. Saloman, August 1976, UNCLASSIFIED.



1. In the swash zone.
2. On the first sandbar, 15 to 61 metres (50 to 200 feet) offshore in about 0.6 metre (2 feet) of water.
3. Between the first and second sandbar at about 2-metre (7-foot) depth.
4. On the second sandbar, about 244 metres (800 feet) offshore at about 1.5-metre (5-foot) depth.
5. Seaward of the second sandbar at 3-metre (10-foot) depth.
6. Seaward at 9-metre (30-foot) depth (Saloman's two stations A and B).

For Habitats 1 through 5, Saloman established collecting stations at nine positions along the beach from West Pass to Phillips' Entrance; for Habitat 6, only two collecting stations were used. Bottom samples were collected at each sampling station using a plug sampler that covered an area  $1/62 \text{ metre}^2$  and penetrated to 23 centimetres. The sampler was diver-operated in depths greater than 1.2 metres (4 feet). Four substratum plugs were collected at each sampling station on each occasion. Sampling was carried out in November 1974 and in February, May, and August 1975. The individual plug samples were sieved and the polychaete worms (and other benthic organisms) removed, preserved, and subsequently identified. The kinds and numbers of polychaetes collected at each of the six habitats on each sampling date were summarized by Saloman<sup>4</sup> in his Tables 18 through 24.

In the present study, the data from those tables were used to construct PACs for the six habitats following the sampling procedures of the first section. In this instance, two sets of PACs were prepared for each habitat--one for warm-water months (May, August) and one for cold-water months (November, February).

## RESULTS

PACs at species, genus, and family levels for each of the six habitats are presented in Tables 2a, 2b, 2c, and 3a, 3b, and 3c for cold-water and warm-water months. The following discussion is based on genus-level PACs unless otherwise indicated.

### Comparison of Panama City Beach Habitats

Inspection of Tables 2b and 3b reveals varying degrees of difference in the PACs of the six habitats examined. Further, there are notable differences between warm-water and cold-water month PAC patterns, which

<sup>4</sup>ibid.



TABLE 2a

SPECIES-LEVEL PACs FOR COLD-WATER MONTHS OF SIX HABITATS AT PANAMA CITY BEACH\*

	HABITAT #1	HABITAT #2	HABITAT #3	HABITAT #4	HABITAT #5	HABITAT #6
Richness	1/2	2/3	6/11	5/9	8/16	23/36
Density	12	104	82	84	47	1944
Diversity	0.47/0.86	0.52/1.05	1.34/1.59	1.76/2.38	2.49/3.23	2.21/2.37
Major species						
Syllides setosa			C/.05	C/.18	C/.02	A/.06
Armandia maculata			C/.02	C/.03		C/.06
Ophelia sp.						D/.64
Paraprionospio pinnata						
Prionospio cristata			C/.02	C/.08	C/.22	
Scolecopsis squamata	C/.29	C/.54	C/.07	C/.29	C/.11	
Scolecopsis texana			C/.02		C/.05	
Spio pettiboneae						C/.02
Paraonis lyra						A/.06
Paraonis fulgens	D/.71	D/.46	D/.73	D/.31	D/.20	
Magelona riojai			A/.02	A/.03	D/.17	

\* Consult Table 1a for explanation of parameters and values.



TABLE 2b

GENUS-LEVEL PACs FOR COLD-WATER MONTHS OF SIX HABITATS AT PANAMA CITY BEACH\*

	HABITAT #1	HABITAT #2	HABITAT #3	HABITAT #4	HABITAT #5	HABITAT #6
Richness	1/2	2/3	5/9	5/9	8/14	20/30
Density	12	104	82	84	47	1944
Diversity	0.47/0.86	0.76/1.05	1.26/1.50	1.76/2.38	2.29/2.99	2.06/2.28
Major Genera						
Syllides			C/.05		C/.04	A/.06
Armandia					C/.03	
Ophelia			C/.02			
Paraprionospio						C/.06
Prionospio			C/.02	C/.08	C/.22	D/.64
Scoelepis	C/.29	C/.53	C/.10	C/.29	C/.17	C/.02
Spio						C/.02
Paraonides						A/.06
Paraonis	D/.71	D/.46	D/.73	C/.31	D/.20	
Magelona			A/.02	A/.05	D/.19	

\* Consult Table 1a for explanation of parameters and values; substitute "genus" for "species" as appropriate.



TABLE 2c  
FAMILY-LEVEL PACs FOR COLD-WATER MONTHS OF SIX HABITATS AT PANAMA CITY BEACH\*

	HABITAT #1	HABITAT #2	HABITAT #3	HABITAT #4	HABITAT #5	HABITAT #6
Richness	1/2	2/3	5/6	5/8	7/12	11/16
Density	12	104	82	84	47	1944
Diversity	0.47/0.86	0.52/1.05	1.21/1.50	1.76/2.09	2.14/2.22	1.27/1.39
Major Families						
Syllidae			A/.08	C/.18		
Opheliidae			C/.02	C/.03	A/.06	A/.09
Spionidae	C/.29	C/.53	D/.13	D/.38	D/.43	D/.76
Paraonidae	D/.71	D/.46	D/.74	D/.32	D/.20	A/.08
Magelonidae			A/.02	A/.05	D/.19	

\*Consult Table 1a for explanation of parameters and values; substitute "family" for "species" as appropriate.



TABLE 3a

SPECIES-LEVEL PACs FOR WARM-WATER MONTHS OF SIX HABITATS AT PANAMA CITY BEACH\*

	HABITAT #1	HABITAT #2	HABITAT #3	HABITAT #4	HABITAT #5	HABITAT #6
Richness	1/1	4/6	12/18	14/21	17/26	23/36
Density	3838	540	738	608	787	1348
Diversity	0/0	0.84/0.86	1.71/1.99	2.06/2.13	2.35/2.58	3.57/3.89
Major Species						
Eteone heteropoda						C/.03
Phyllodoce arenae						C/.02
Phyllodoce sp.						C/.02
Glycera oxycephala						C/.02
Nephtys buccera			C/.02	C/.02	A/.03	
Nephtys plecta						A/.06
Brania wellfleetensis						C/.03
Armandia maculata						D/.14
Dispio uncinata			D/.30	D/.44	D/.16	
Pronospio cristata				C/.03		A/.09
Scolecopsis squamata	D/1.00	D/.67				
Scolecopsis sp.						C/.05
Spio pettiboneae			D/.50	A/.07	D/.41	D/.11
Spiophanes bombyx			C/.02		C/.06	D/.24
Paraonis fulgens		D/.12	A/.06	D/.34	D/.12	
Lumbrineris sp.						C/.04
Magelona riojai			A/.05	A/.05	D/.16	

\*Consult Table 1a for explanation of parameters and values.



TABLE 3b

GENUS-LEVEL PACs FOR WARM-WATER MONTHS OF SIX HABITATS AT PANAMA CITY BEACH\*

	HABITAT #1	HABITAT #2	HABITAT #3	HABITAT #4	HABITAT #5	HABITAT #6
Richness	1/1	4/6	12/17	12/16	15/21	20/29
Density	3838	540	738	608	787	1348
Diversity	0/0	0.84/0.86	1.70/1.98	2.02/2.08	2.30/2.44	3.43/3.55
Major Genera						
Eteone						C/.04
Phyllodoce						C/.04
Glycera						C/.02
Nephtys			C/.02	A/.02	A/.03	A/.07
Brania						C/.03
Armandia						D/.14
Dispio			D/.30	D/.44	D/.16	
Prionospio						A/.09
Scolecopsis		D/.67		C/.03		C/.05
Spio	D/1.00		D/.50	A/.07	D/.41	D/.11
Spiophanes			C/.02		C/.06	D/.24
Paraonis		D/.12	D/.06	D/.34	D/.12	
Lumbrineris						
Magelona			A/.05	A/.06	D/.16	C/.04

\*Consult Table 1a for explanation of parameters and values; substitute "genus" for "species" as appropriate.



Table 3c

## FAMILY-LEVEL PACs FOR WARM-WATER MONTHS OF SIX HABITATS AT PANAMA CITY BEACH\*

	HABITAT #1	HABITAT #2	HABITAT #3	HABITAT #4	HABITAT #5	HABITAT #6
Richness	1/1	2/3	7/8	7/9	9/12	11/15
Density	3838	540	738	608	787	1348
Diversity	0/0	0.70/0.77	0.91/0.93	1.50/1.49	1.57/1.60	2.38/2.39
Major Families						
Phyllodocidae						A/.09
Glyceridae						C/.02
Nephtyidae			A/.02	A/.02	A/.04	A/.08
Syllidae						C/.03
Opheliidae						D/.16
Spionidae	D/1.00	D/.68	D/.84	D/.56	D/.65	D/.52
Paraonidae		D/.12	A/.06	D/.34	D/.12	
Lumbrineridae						
Magelonidae			A/.05	A/.06	D/.16	C/.04

\* Consult Table 1a for explanation of parameters and values; substitute "family" for "species" as appropriate.



indicate the importance of considering the seasons of sampling when polychaete collections are pooled for PAC preparation and analysis.

In data for both seasons, there is a trend for increasing genus richness with increasing distance from shore. A similar trend exists for genus diversity in summer; however, in winter the deepest habitat (Habitat 6) shows slightly less diversity than does Habitat 5. Density is quite variable among habitats in both seasons with greatest densities in nearest shore (Habitat 1) and farthestest from shore (Habitat 6) in summer. In the former case, this is due to one species occurring in very high numbers; in the latter, to several species in relatively high numbers.

Major forms of the six habitats cluster into three groups with the two inshore habitats (1 and 2) narrowly limited to genera, mid-depth habitats (3, 4, and 5) having more numerous and similar genera, and the deepest habitat (6) having the most numerous and distinct major genera. The parameters of richness, density, and diversity likewise tend to cluster into these three groupings. This suggests that six localities arbitrarily chosen for sampling, and here called habitats, might more naturally comprise three broader environmental habitats or zones in terms of polychaete assemblages.

Table 4 presents genus-level PACs for these three clusters of habitats in cold-water and warm-water months, here denominated as the (1) Shallow-Water Zone (Habitats 1 and 2), (2) Mid-Depth Zone (Habitats 3, 4, and 5), and (3) Deep-Water Zone (Habitat 6).

#### Comparison of PACs from Panama City Beach and Mexico Beach

Polychaete sampling for PAC preparation should normally follow uniform procedures when conducted at given localities by a single investigator or institution. Thus, for purposes of local environmental monitoring and assessment, the resulting PACs should be directly comparable. However, differences in sampling procedure are to be expected from workers in different localities, especially when data are collected primarily for purposes other than PAC preparation and use. For example, Saloman's<sup>4</sup> Panama City Beach polychaete collections were made over a briefer period of time than those at Mexico Beach; collecting apparatus was different; volumes of substrate per sample and depth of substrate sampled were different; more habitats were sampled at Panama City Beach, and there were more sampling points per habitat.

While it would be useful to compare PACs from different geographic or environmental situations, differing sampling procedures make such comparisons suspect. But since PACs are, in effect, averages of averages, there may be sufficient compatibility among reasonably similar procedures to allow for certain PAC comparisons. To investigate this possibility, PACs from Mexico Beach and Panama City Beach are examined here. Only warm-water month data are used since cold-water PACs were not prepared for Mexico Beach.

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<sup>4</sup>ibid.



TABLE 4  
GENUS-LEVEL PACs FOR THREE ZONES AT PANAMA CITY BEACH\*

	COLD-WATER MONTHS			WARM-WATER MONTHS		
	SHALLOW WATER ZONE #1,2	MID-DEPTH ZONE #3,4,5	DEEP WATER ZONE #6	SHALLOW WATER ZONE #1,2	MID-DEPTH ZONE #3,4,5	DEEP WATER ZONE #6
Richness	2/3	11/19	20/30	4/6	19/26	20/29
Density	58	70	1944	2100	710	1348
Diversity	0.52/1.05	2.07/2.52	2.06/2.28	0.36/0.13	2.19/2.44	3.43/3.55
Major Genera						
Eteone						C/.04
Phyllodoce						C/.04
Glycera						C/.02
Nephtys					A/.02	A/.07
Brania						C/.03
Armandia			A/.06			D/.04
Dispio					D/.29	
Paraprionospio			C/.06			A/.09
Prionospio			D/.64			C/.05
Scolecopsis			C/.02	D/.98	D/.34	D/.11
Spio			C/.02		C/.03	D/.21
Spiophanes						
Paraonides			A/.06			
Paraonis	D/.49	D/.45			D/.16	C/.04
Lumbrineris						
Magelona		A/.07			A/.09	

\*Consult Table 1a for explanation of parameters and values; substitute "genus" for "species" as appropriate.



Tables 1b and 4 present genus-level PACs from Mexico Beach and Panama City Beach for comparison. Inspection of these tables indicates that the Panama City Beach Shallow-Water Zone PAC is sharply distinct from any of the Mexico Beach PACs. Thus, comparison of PACs from different localities, developed from different sampling procedures, does allow recognition of notably distinctive polychaete assemblages and, by extension, of habitats.

Similarly, regular presence of major forms in one locality and their absence in another, though determined under different sampling procedures, suggest genuine and significant difference in the two localities. In the present case, the genera Onuphis and Microphthalmus are important members of virtually all Mexico Beach habitats, but neither appears on major genera lists from Panama City Beach.

Genus richness is roughly comparable between the two inlet habitats of Mexico Beach and the medium and deeper water zones of Panama City Beach. But the greater areas sampled and longer period of sampling at Mexico Beach would be expected to generate a longer list of infrequent or rare species, and thus, show greater richness. Thus, this parameter should be viewed with caution. Densities are generally higher at Panama City, except between the Inlet Outer Habitat of Mexico Beach and the Mid-Depth Zone at Panama City Beach. In this case, the deeper samples taken at Panama City (23 centimetres deep versus 10 centimetres deep at Mexico Beach) introduce the need for caution. Diversity indices are fairly close between the Beach Inner Habitat of Panama City and the Mexico Beach Mid-Depth Zone, and between the Inlet Outer Habitat and Deep-Water Zone. Major genera lists are broadly similar in numbers but vary widely in kinds of genera. Thus, no clear relationships emerge between habitats of the two localities from comparison of PACs derived from different sampling procedures.

By chance, there was overlapping between dates of sampling at Panama City Beach (May and August 1975) and at Mexico Beach (April and August 1975). As a sort of control, PACs were developed for Mexico Beach habitats for these dates and were compared with Panama City Beach PACs. Table 5 presents these PACs.

Inspection of Table 5 shows somewhat closer correspondence among PACs from the two areas than is apparent using the 2-year PACs of Mexico Beach. Again, the Shallow-Water Zone of Panama City Beach is seen as a unique environmental situation. The Inlet and Beach Inner Habitats at Mexico Beach most nearly resemble the Mid-Depth Zone of Panama City Beach in polychaete assemblage characteristics, noting the exception of Microphthalmus' importance in the former and Spio and Dispio's in the latter. Similarly, the Inlet and Beach Outer Habitat PACs are most like that of the Deep-Water Zone. Thus, there are apparently some broad environmental relationships to be seen among the areas investigated in the two localities, but they are distinct in important ways or else sampling differences obscure more basic similarities.



TABLE 5

## GENUS-LEVEL PACs FROM MEXICO BEACH AND PANAMA CITY BEACH, SUMMER 1975\*

	MEXICO BEACH, APR & AUG 1975				PANAMA CITY BEACH, MAY & AUG 1975		
	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT	SHALLOW WATER ZONE	MID-DEPTH ZONE	DEEP WATER ZONE
Richness	11/16	11/14	41/54	24/38	4/6	19/26	20/29
Density	750	738	3045	881	2100	710	1348
Diversity	2.56/2.52	1.62/1.22	3.16/3.55	3.04/3.78	0.36/0.13	2.19/2.44	3.43/3.55
Major Genera							
Eteone							C/.04
Phyllodoce							C/.04
Glycera							C/.02
Microneptys							
Nephtys	D/.70	C/.03	D/.10	D/.10		A/.02	A/.07
Brania			C/.06	C/.06			C/.03
Microphthalmus	D/.22	D/.81	C/.08	C/.08			
Armandia			C/.04	C/.04			D/.04
Travisia							
Dispio						D/.29	
Paraprionospio							
Prionospio			A/.02	C/.02			A/.09
Scolecopsis					D/.98		C/.05
Spio						D/.34	D/.11
Spiophanes		C/.02	D/.16	D/.14		C/.03	D/121
Paraonis	A/.07	C/.04				D/.16	
Onuphis			C/.02	C/.10			
Lumbrineris							
Magelona	D/.27	A/.04	D/.29	D/.18		A/.09	C/.04
undet cirratulid							
Asabellides			C/.04	C/.02			

\* Consult Table 1a for explanation of parameters and values; substitute "genus" for "species" as appropriate.



## SUMMARY AND CONCLUSIONS

Using extensive collections of benthic polychaete annelid worms taken over a 2-year period from four assumed polychaete habitats in the nearshore area of Mexico Beach, Florida, a procedure was devised to reduce the large amount of sampling data obtained to averages of three basic community parameters and a listing of major kinds of polychaetes found in the collections. The resulting sets of averages and lists, Polychaete Assemblage Characterizations (PACs), were seen to differ one from another among the four habitats examined. Differences were greater between PACs of more divergent types of habitat; e.g., inlet and beach inner locations.

These findings indicate that PACs may provide a useful summary presentation of detail and complex polychaete sampling data from a given locality over time which characterizes and defines the average polychaete assemblage occurring there. Thus, once established, the PAC of a locality or habitat may serve as a data base to monitor and assess relative environmental stability or change there as reflected in subsequent polychaete sampling. Comparison of PACs from different sampling points or localities serves to indicate the degree of environmental similarity or difference between the areas under consideration. Thus, sampling sites from two areas may be found to be of the same habitat type and so be treated together, or decidedly different habitat types, requiring separate treatment in monitoring, analysis, and assessment.

Ideally, for comparison, PACs should come from data collected under like sampling procedures. However, examination of data from Mexico Beach and Panama City Beach, which involved different sampling procedures, did suggest that their respective PACs could, with caution, be usefully compared for broader indications of similarity and difference among the habitats. PACs developed from warm-water months and cold-water months sampling in Panama City Beach habitats were notably different. Thus, PAC comparisons must involve data collected in comparable seasons.

As presented herein, PACs may be prepared at the level of species, genus, and family. Inspection of the PACs produced in this study showed little loss of detail or information between respective species-level and genus-level PACs; essentially the same conclusions could be drawn using either. Since data collecting at genus level can be carried out at appreciable savings of time and resources over species level, it is recommended that further development and use of PAC procedures concentrate on the polychaete genus. Family-level PACs are effective, too, but there is a greater loss of detail. On the other hand, family-level PACs may prove most useful in comparing polychaete assemblages of widely separated geographical areas. They also provide information on certain groups of polychaetes important in a habitat not otherwise revealed in PACs of lower taxa.

Examination of the polychaete lists from individual samples and sampling dates, carried out in preparing the PACs, made one important fact



very evident: the number and kinds of polychaetes taken in samples vary widely from point to point and day to day, all other things apparently equal. Samples taken within 1000 centimetres of each other may contain widely divergent collections of polychaetes. Thus, one should not expect PACs of the same or similar habitats necessarily to be identical. PAC comparison involves relative degrees and patterns of similarity and difference. Further development of and experience with PACs should help resolve this inherent problem. On the other hand, the normal variation found in polychaete assemblages from sample to sample emphasizes the importance and usefulness of procedures like the PAC which are, in effect, averages of averages. To be most successful for environmental monitoring and assessment, PACs should be developed with emphasis on numerous polychaete samples taken frequently over protracted periods of time.



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APPENDIX A

SPECIES AND NUMBERS OF POLYCHAETES COLLECTED FROM  
EACH HABITAT AT MEXICO BEACH, FLORIDA,  
ON EACH SAMPLING DATE



## POLYCHAETES COLLECTED IN AUGUST 1973

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Phyllodocidae</b>				
Eteone alba				
Eteone lactea				
Eulalia sanguinea				
Paranaitis speciosa				
Phyllodoce arenae	1		15	1
undet. phyllodocid				
<b>Polynoidae</b>				
Harmothoe lunulata			1	2
Harmothoe sp.			1	1
undet. polynoid				
<b>Sigalionidae</b>				
Sthenelais boa				
<b>Eulepthidae</b>				
Pareulepis fimbriata			7	7
<b>Glyceridae</b>				
Glycera americana		7	6	1
Glycera capitata				4
Glycera convoluta				
Glycera dibranchiata			4	
Glycera oxycephala				
Glycera sp.				
<b>Goniadidae</b>				
Glycinde polygnatha		1		1
Glycinde sp.			1	
Goniada littorea		1	1	5
<b>Nephtyidae</b>				
Micronephtys sp.				
Nephtys bucera	16	13	12	52
Nephtys picta	41	32	30	
Nephtys sp.				



## POLYCHAETES COLLECTED IN AUGUST 1973

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Syllidae</b>				
<i>Brania wellfleetensis</i>	1			1
<i>Syllides</i> sp.				
<i>Syllis cornuta</i>				1
undet. syllid				
<b>Hesionidae</b>				
<i>Microphthalmus szcelkowi</i>	12	50		1
<i>Microphthalmus</i> sp.	2			
<i>Podarmus</i> sp.				
undet. hesionid				
<b>Pilargidae</b>				
<i>Sigambra bassi</i>	1			2
<i>Sigambra tentaculata</i>				
<b>Nereidae</b>				
<i>Ceratonereis irritabilis</i>				
<i>Nereis acuminata</i>	1	2		
<i>Nereis pelagica</i>			2	
<i>Nereis succinea</i>	2		4	1
<i>Rullierinereis mexicana</i>		2	55	9
<i>Websterinereis glauca</i>				
undet. nereid		2	9	
<b>Capitellidae</b>				
<i>Capitella capitata</i>				5
<i>Dasybranchus lumbricoides</i>				
<i>Heteromastus filiformis</i>			6	2
<i>Mediomastus californiensis</i>				
<i>Notomastus hemipodus</i>				
<i>Notomastus latericeus</i>				
<i>Notomastus lunulatus</i>				21
<i>Notomastus</i> sp.				
<i>Parheteromastus tenuis</i>				49
<b>Arenicolidae</b>				
<i>Arenicola cristata</i>			1	2



## POLYCHAETES COLLECTED IN AUGUST 1973

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Maldanidae</b>				
<i>Axiiothella mucosa</i>				
<i>Branchiosychis americana</i>				
<i>Clymenella mucosa</i>				
undet. maldanid				
<b>Opheliidae</b>				
<i>Armandia agilis</i>	145	22	86	1
<i>Armandia maculata</i>				
<i>Ophelia denticutata</i>				
<i>Travisia</i> sp.				
<b>Spionidae</b>				
<i>Dispio uncinata</i>	104	40	14	
<i>Paraprionospio pinnata</i>			1	
<i>Polydora ciliata</i>				
<i>Polydora socialis</i>	5		2	3
<i>Polydora tetrabanchia</i> (?)	2		4	
<i>Polydora websteri</i>	3			
<i>Polydora</i> sp.	4		3	
<i>Polydorella prolifera</i>				6
<i>Prionospio cirrifer</i>			1	11
<i>Prionospio cristata</i>	1		10	
<i>Prionospio ehlersi</i>				2
<i>Prionospio malmgreni</i>				10
<i>Prionospio pygmaea</i>	7		8	44
<i>Prionospio sexoculata</i>				6
<i>Prionospio steenstrupi</i>				
<i>Prionospio</i> sp.	1			
<i>Pseudopolydora</i> sp.			3	
<i>Scoelelepis squamata</i>	130		3	25
<i>Scoelelepis texana</i>				
<i>Scoelelepis</i> sp.				
<i>Spio filicornis</i>	120		4	18
<i>Spio pettiboneae</i>	8			
<i>Spio</i> sp.				
<i>Spiophanes bombyx</i>	5		21	15
<i>Streblospio benedicti</i>				1
<b>Paraonidae</b>				
<i>Aricidea fragilis</i>				
<i>Aricidea taylori</i>				
<i>Aricidea</i> sp.			1	
<i>Paraonis fulgens</i>	2		2	
undet. paraonid				



## POLYCHAETES COLLECTED IN AUGUST 1973

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Chaetopteridae</b>				
<i>Mesochaetopterus</i> sp.	3		2	
<i>Spiochaetopterus oculatus</i>				2
<b>Onuphiidae</b>				
<i>Diopatra cuprea</i>				
<i>Onuphis eremita</i>	250	109	2243	144
<i>Onuphis magna</i>				
<b>Lumbrineridae</b>				
<i>Lumbrineris erecta</i>	2			
<i>Lumbrineris parvapedata</i>	1		3	8
<i>Lumbrineris tenuis</i>			1	
<i>Lumbrineris tetraura</i>				12
<i>Lumbrineris</i> sp.	4		55	
<b>Dorvilleidae</b>				
<i>Dorvillea rudolphi</i>				
<b>Amphinomidae</b>				
<i>Eurythoe complanata</i>				
<i>Pseudeurythoe paucibranchiata</i>				
<i>Pseudeurythoe</i> sp.				
undet. amphinomid				
<b>Euphrosinidae</b>				
<i>Euphrosine triloba</i>				
<b>Magelonidae</b>				
<i>Magelona filiformis</i>			2	
<i>Magelona longicornis</i>				19
<i>Magelona pettiboneae</i>	3			
<i>Magelona riojai</i>	104	31	18	
<i>Magelona</i> sp.				



## POLYCHAETES COLLECTED IN AUGUST 1973

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Orbiniidae</b>				
Haploscoloplos foliosus	2			
Haploscoloplos fragilis	10			2
Haploscoloplos robustus				
Naineris sp.				
Scoloplos fragilis			2	
Scoloplos rubra			2	16
Scoloplos sp.			1	
undet. orbiniid	2	1		
<b>Cirratulidae</b>				
Cirriformia grandis				3
undet. cirratulid				
<b>Oweniidae</b>				
Myriochele sp.				
Owenia fusiformis				
<b>Pectinariidae</b>				
Pectinaria gouldii			1	2
<b>Ampharetidae</b>				
Asabellides lineata				28
Asabellides oculata			1	
undet. ampharetid			2	
<b>Terebellidae</b>				
Loimia medusa			1	
Loimia viridis				
<b>Sabellidae</b>				
Chone dumeri				
Chone sp.			2	
Euchone sp.				5
undet. sabellid				



## POLYCHAETES COLLECTED IN APRIL 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Phyllodocidae				
Eteone alba				
Eteone lactea				
Eulalia sanguinea			1	1
Paranaitis speciosa	7		39	6
Phyllodoce arenae				
undet. phyllodocid				
Polynoidae				
Harmothoe lunulata				1
Harmothoe sp.				
undet. polynoid				
Sigalionidae				
Sthenelais boa				
Eulepthidae				
Pareulepis fimbriata			32	3
Glyceridae				
Glycera americana				
Glycera capitata			1	
Glycera convoluta			24	4
Glycera dibranchiata	2			
Glycera oxycephala				
Glycera sp.				
Goniadidae				
Glycinde polygnatha			4	
Glycinde sp.				
Goniada littorea			2	1
Nephtyidae				
Micronephtys sp.				
Nephtys bucera	148	40	68	10
Nephtys picta			1	2
Nephtys sp.				



## POLYCHAETES COLLECTED IN APRIL 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Syllidae</b>				
<i>Brania wellfleetensis</i>				
<i>Syllides</i> sp.				
<i>Syllis cornuta</i>				
undet. syllid				
<b>Hesionidae</b>				
<i>Microphthalmus szcelkowi</i>	632	8	26	
<i>Microphthalmus</i> sp.	259	4		
<i>Podarmus</i> sp.				
undet. hesionid				
<b>Pilargidae</b>				
<i>Sigambra bassi</i>	2			
<i>Sigambra tentaculata</i>				
<b>Nereidae</b>				
<i>Ceratonereis irritabilis</i>				
<i>Nereis acuminata</i>	1			
<i>Nereis pelagica</i>				
<i>Nereis succinea</i>	2		2	
<i>Rullierinereis mexicana</i>				1
<i>Websterinereis glauca</i>			1	
undet. nereid				
<b>Capitellidae</b>				
<i>Capitella capitata</i>				
<i>Dasybranchus lumbricoides</i>				
<i>Heteromastus filiformis</i>				
<i>Mediomastus californiensis</i>			4	11
<i>Notomastus hemipodus</i>				1
<i>Notomastus latericeus</i>				
<i>Notomastus lunulatus</i>				
<i>Notomastus</i> sp.				
<i>Parheteromastus tenuis</i>				6
<b>Arenicolidae</b>				
<i>Arenicola cristata</i>				



## POLYCHAETES COLLECTED IN APRIL 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Maldanidae</b>				
<i>Axiiothella mucosa</i>				
<i>Branchiosychis americana</i>				
<i>Clymenella mucosa</i>				
undet. maldanid				
<b>Opheliidae</b>				
<i>Armandia agilis</i>			10	3
<i>Armandia maculata</i>				
<i>Ophelia denticutata</i>				
<i>Travisia</i> sp.				
<b>Spionidae</b>				
<i>Dispio uncinata</i>				
<i>Paraprionospio pinnata</i>			3	
<i>Polydora ciliata</i>	7	9	22	1
<i>Polydora socialis</i>				
<i>Polydora tetrabanchia</i> (?)				
<i>Polydora websteri</i>				
<i>Polydora</i> sp.				
<i>Polydorella prolifera</i>	1			
<i>Prionospio cirrifera</i>				
<i>Prionospio cristata</i>				
<i>Prionospio ehlersi</i>				
<i>Prionospio malmgreni</i>				
<i>Prionospio pygmaea</i>			1	1
<i>Prionospio sexoculata</i>				1
<i>Prionospio steenstrupi</i>				
<i>Prionospio</i> sp.				
<i>Pseudopolydora</i> sp.				
<i>Scoelelepis squamata</i>	6	47	20	8
<i>Scoelelepis texana</i>				
<i>Scoelelepis</i> sp.				
<i>Spio filicornis</i>	3	1	1	2
<i>Spio pettiboneae</i>			2	
<i>Spio</i> sp.				
<i>Spiophanes bombyx</i>	191	12	222	131
<i>Streblospio benedicti</i>	2			
<b>Paraonidae</b>				
<i>Aricidea fragilis</i>				
<i>Aricidea taylori</i>				
<i>Aricidea</i> sp.				
<i>Paraonis fulgens</i>	90	10	6	1
undet. paraonid				



## POLYCHAETES COLLECTED IN APRIL 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Chaetopteridae				
Mesochaetopterus sp.				
Spiochaetopterus oculatus				
Onuphiidae				
Diopatra cuprea				
Onuphis eremita	140	10	588	75
Onuphis magna				
Lumbrineridae				
Lumbrineris erecta				
Lumbrineris parvapedata			2	4
Lumbrineris tenuis				
Lumbrineris tetraura				
Lumbrineris sp.			2	4
Dorvilleidae				
Dorvillea rudolphi				
Amphinomidae				
Eurythoe complanata				
Pseudeurythoe paucibranchiata			3	2
Pseudeurythoe sp.				
undet. amphinomid				
Euphrosinidae				
Euphrosine triloba				
Magelonidae				
Magelona filiformis				
Magelona longicornis				
Magelona pettiboneae				
Magelona riojai	27		22	3
Magelona sp.				1



## POLYCHAETES COLLECTED IN APRIL 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Orbiniidae				
Haploscoloplos foliosus				
Haploscoloplos fragilis				
Haploscoloplos robustus				
Naineris sp.				
Scoloplos fragilis	95	3	3	5
Scoloplos rubra				
Scoloplos sp.				
undet. orbiniid	6			
Cirratulidae				
Cirriformia grandis				
undet. cirratulid				
Oweniidae				
Myriochele sp.				
Owenia fusiformis			1	
Pectinariidae				
Pectinaria gouldii			1	1
Ampharetidae				
Asabellides lineata			3	
Asabellides oculata				
undet. ampharetid				
Terebellidae				
Loimia medusa				
Loimia viridis				
Sabellidae				
Chone dumeri				
Chone sp.				
Euchone sp.				
undet. sabellid				



## POLYCHAETES COLLECTED IN MAY 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Phyllodoceidae				
Eteone alba			1	
Eteone lactea				
Eulalia sanguinea				
Paranaitis speciosa				
Phyllodoce arenae	2	1	17	11
undet. phyllodocid			1	
Polynoidae				
Harmothoe lunulata				
Harmothoe sp.				
undet. polynoid				
Sigalionidae				
Sthenelais boa				1
Eulepthidae				
Pareulepis fimbriata			76	17
Glyceridae				
Glycera americana				
Glycera capitata				
Glycera convoluta				
Glycera dibranchiata				
Glycera oxycephala				
Glycera sp.			9	
Goniadidae				
Glycinde polygnatha				
Glycinde sp.				1
Goniada littorea	1		1	2
Nephtyidae				
Micronephtys sp.				
Nephtys bucera	62	12	23	2
Nephtys picta	2		17	7
Nephtys sp.	1		2	1



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POLYCHAETES COLLECTED IN MAY 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Syllidae				
Brania wellfleetensis				
Syllides sp.				
Syllis cornuta				
undet. syllid	154	46	4	11
Hesionidae				
Microphthalmus szcelkowi	37		7	
Microphthalmus sp.	5			
Podarmus sp.				
undet. hesionid				
Pilargidae				
Sigambra bassi	1			
Sigambra tentaculata				
Nereidae				
Ceratonereis irritabilis				
Nereis acuminata				
Nereis pelagica			1	5
Nereis succinea				
Rullierinereis mexicana				
Websterinereis glauca				
undet. nereid				
Capitellidae				
Capitella capitata				
Dasybranchus lumbricoides				
Heteromastus filiformis				
Mediomastus californiensis			46	
Notomastus hemipodus			13	21
Notomastus latericeus			1	
Notomastus lunulatus				
Notomastus sp.				
Parheteromastus tenuis			31	5
Arenicolidae				
Arenicola cristata				



## POLYCHAETES COLLECTED IN MAY 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Maldanidae</b>				
<i>Axiiothella mucosa</i>				
<i>Branchiosychis americana</i>				
<i>Clymenella mucosa</i>				
undet. maldanid				
<b>Opheliidae</b>				
<i>Armandia agilis</i>	4		17	4
<i>Armandia maculata</i>				
<i>Ophelia denticutata</i>				
<i>Travisia</i> sp.				
<b>Spionidae</b>				
<i>Dispio uncinata</i>				
<i>Paraprionospio pinnata</i>				
<i>Polydora ciliata</i>				
<i>Polydora socialis</i>			8	
<i>Polydora tetrabanchia</i> (?)				
<i>Polydora websteri</i>				
<i>Polydora</i> sp.				
<i>Polydorella prolifera</i>				
<i>Prionospio cirrifera</i>				
<i>Prionospio cristata</i>				
<i>Prionospio ehlersi</i>				
<i>Prionospio malmgreni</i>				
<i>Prionospio pygmaea</i>			10	6
<i>Prionospio sexoculata</i>				
<i>Prionospio steenstrupi</i>				1
<i>Prionospio</i> sp.				
<i>Pseudopolydora</i> sp.				
<i>Scoelelepis squamata</i>	118	45	12	6
<i>Scoelelepis texana</i>			1	
<i>Scoelelepis</i> sp.	3			3
<i>Spio filicornis</i>			1	
<i>Spio pettiboneae</i>				
<i>Spio</i> sp.			9	46
<i>Spiophanes bombyx</i>	26	63		
<i>Streblospio benedicti</i>				
<b>Paraonidae</b>				
<i>Aricidea fragilis</i>				
<i>Aricidea taylori</i>				
<i>Aricidea</i> sp.				
<i>Paraonis fulgens</i>	115	7	1	
undet. paraonid				



## POLYCHAETES COLLECTED IN MAY 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Chaetopteridae				
Mesochaetopterus sp.				
Spiochaetopterus oculatus				
Onuphiidae				
Diopatra cuprea				
Onuphis eremita	129	6	237	180
Onuphis magna				
Lumbrineridae				
Lumbrineris erecta			1	
Lumbrineris parvapedata				
Lumbrineris tenuis			1	
Lumbrineris tetraura				
Lumbrineris sp.	1		8	1
Dorvilleidae				
Dorvillea rudolphi				
Amphinomidae				
Eurythoe complanata				
Pseudeurythoe paucibranchiata				
Pseudeurythoe sp.				
undet. amphinomid				1
Euphrosinidae				
Euphrosine triloba				1
Magelonidae				
Magelona filiformis			2	
Magelona longicornis			9	
Magelona pettiboneae				
Magelona riojai	47	1	31	8
Magelona sp.				



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POLYCHAETES COLLECTED IN MAY 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Orbiniidae</b>				
Haploscoloplos foliosus			1	
Haploscoloplos fragilis	2		1	
Haploscoloplos robustus				
Naineris sp.				
Scoloplos fragilis	16	15		
Scoloplos rubra			3	3
Scoloplos sp.				
undet. orbiniid				
<b>Cirratulidae</b>				
Cirriformia grandis				
undet. cirratulid				
<b>Oweniidae</b>				
Myriochele sp.				
Owenia fusiformis			5	
<b>Pectinariidae</b>				
Pectinaria gouldii			3	
<b>Ampharetidae</b>				
Asabellides lineata				
Asabellides oculata				
undet. ampharetid				
<b>Terebellidae</b>				
Loimia medusa				
Loimia viridis				
<b>Sabellidae</b>				
Chone dumeri			8	
Chone sp.				
Euchone sp.				
undet. sabellid				



## POLYCHAETES COLLECTED IN AUGUST 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Phyllodocidae				
Eteone alba			2	1
Eteone lactea				
Eulalia sanguinea				
Paranaitis speciosa	2		11	8
Phyllodoce arenae				
undet. phyllodocid				
Polynoidae				
Harmothoe lunulata				
Harmothoe sp.				
undet. polynoid				
Sigalionidae				
Sthenelais boa				
Eulepthidae				
Pareulepis fimbriata			41	71
Glyceridae				
Glycera americana				
Glycera capitata				
Glycera convoluta				
Glycera dibranchiata				
Glycera oxycephala	1		1	
Glycera sp.				
Goniadidae				
Glycinde polygnatha			3	4
Glycinde sp.			1	1
Goniada littorea				
Nephtyidae				
Micronephtys sp.				
Nephtys bucera	14	14	3	
Nephtys picta	2	1	15	1
Nephtys sp.				



## POLYCHAETES COLLECTED IN AUGUST 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Syllidae</b>				
<i>Brania wellfleetensis</i>				
<i>Syllides</i> sp.	13		5	4
<i>Syllis cornuta</i>				3
undet. syllid				
<b>Hesionidae</b>				
<i>Microphthalmus szcelkowi</i>	25	159	113	1
<i>Microphthalmus</i> sp.				
<i>Podarmus</i> sp.				
undet. hesionid				
<b>Pilargidae</b>				
<i>Sigambra bassi</i>			5	
<i>Sigambra tentaculata</i>			12	33
<b>Nereidae</b>				
<i>Ceratonereis irritabilis</i>			2	13
<i>Nereis acuminata</i>			13	1
<i>Nereis pelagica</i>				
<i>Nereis succinea</i>			43	5
<i>Rullierinereis mexicana</i>			15	28
<i>Websterinereis glauca</i>			3	
undet. nereid			2	
<b>Capitellidae</b>				
<i>Capitella capitata</i>				
<i>Dasybranchus lumbricoides</i>				
<i>Heteromastus filiformis</i>				
<i>Mediomastus californiensis</i>			8	37
<i>Notomastus hemipodus</i>			2	
<i>Notomastus latericeus</i>	1		2	4
<i>Notomastus lunulatus</i>				
<i>Notomastus</i> sp.				5
<i>Parheteromastus tenuis</i>				
undet. capitellid			1	
<b>Arenicolidae</b>				
<i>Arenicola cristata</i>				



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POLYCHAETES COLLECTED IN AUGUST 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Maldanidae</b>				
Axiiothella mucosa			1	
Branchiosychis americana				3
Clymenella mucosa			1	2
undet. maldanid				
<b>Opheliidae</b>				
Armandia agilis	1110	651	1506	1062
Armandia maculata				
Ophelia denticutata				
Travisia sp.				
<b>Spionidae</b>				
Dispio uncinata	319	41	70	
Paraprionospio pinnata			1	2
Polydora ciliata				
Polydora socialis				
Polydora tetrabanchia (?)				
Polydora websteri				
Polydora sp.	3	1	6	1
Polydorella prolifera				
Prionospio cirrifer			3	16
Prionospio cristata			84	49
Prionospio ehlersi				
Prionospio malmgreni				
Prionospio pygmaea			1	7
Prionospio sexoculata				
Prionospio steenstrupi				
Prionospio sp.				
Pseudopolydora sp.				
Scolecopsis squamata				
Scolecopsis texana			4	2
Scolecopsis sp.			2	1
Spio filicornis				
Spio pettiboneae	5		15	6
Spio sp.				
Spiophanes bombyx	5		18	8
Streblospio benedicti				
<b>Paraonidae</b>				
Aricidea fragilis			2	
Aricidea taylori				
Aricidea sp.	1		5	9
Paraonis fulgens	51	88	27	
undet. paraonid			3	



## POLYCHAETES COLLECTED IN AUGUST 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Chaetopteridae</b>				
<i>Mesochaetopterus</i> sp.			2	2
<i>Spiochaetopterus oculatus</i>			2	1
<b>Onuphiidae</b>				
<i>Diopatra cuprea</i>				
<i>Onuphis eremita</i>	947	29	91	77
<i>Onuphis magna</i>				1
<b>Lumbrineridae</b>				
<i>Lumbrineris erecta</i>				
<i>Lumbrineris parvapedata</i>				
<i>Lumbrineris tenuis</i>			11	15
<i>Lumbrineris tetraura</i>				
<i>Lumbrineris</i> sp.			103	111
<b>Dorvilleidae</b>				
<i>Dorvillea rudolphi</i>			3	5
<b>Amphinomidae</b>				
<i>Eurythoe complanata</i>				
<i>Pseudeurythoe paucibranchiata</i>				
<i>Pseudeurythoe</i> sp.				
undet. amphinomid			1	3
<b>Euphrosinidae</b>				
<i>Euphrosine triloba</i>				
<b>Magelonidae</b>				
<i>Magelona filiformis</i>			23	3
<i>Magelona longicornis</i>				5
<i>Magelona pettiboneae</i>				
<i>Magelona riojai</i>	14			
<i>Magelona</i> sp.	2	13		



## POLYCHAETES COLLECTED IN AUGUST 1974

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Orbiniidae				
Haploscoloplos foliosus	1		1	3
Haploscoloplos fragilis				
Haploscoloplos robustus				
Naineris sp.				
Scoloplos fragilis	2			3
Scoloplos rubra			6	23
Scoloplos sp.		2		
undet. orbiniid			1	
Cirratulidae				
Cirriformia grandis				
undet. cirratulid			24	66
Oweniidae				
Myriochele sp.				
Owenia fusiformis				5
Pectinariidae				
Pectinaria gouldii			6	12
Ampharetidae				
Asabellides lineata				
Asabellides oculata			1	1
undet. ampharetid				
Terebellidae				
Loimia medusa	1			
Loimia viridis	1		3	3
Sabellidae				
Chone dumeri				
Chone sp.				
Euchone sp.				
undet. sabellid			2	7



## POLYCHAETES COLLECTED IN APRIL 1975

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Phyllodocidae</b>				
Eteone alba				
Eteone lactea			2	1
Eulalia sanguinea			1	
Paranaitis speciosa				
Phyllodoce arenae			6	2
undet. phyllodocid			1	
<b>Polynoidae</b>				
Harmothoe lunulata				1
Harmothoe sp.				
undet. polynoid				1
<b>Sigalionidae</b>				
Sthenelais boa			14	1
<b>Eulepthidae</b>				
Pareulepis fimbriata			3	12
<b>Glyceridae</b>				
Glycera americana			8	4
Glycera capitata				
Glycera convoluta				
Glycera dibranchiata				
Glycera oxycephala			8	1
Glycera sp.				
<b>Goniadidae</b>				
Glycinde polygnatha				
Glycinde sp.			3	
Goniada littorea				
<b>Nephtyidae</b>				
Micronephtys sp.			2	5
Nephtys bucera	126	21	51	28
Nephtys picta	3		35	16
Nephtys sp.				



## POLYCHAETES COLLECTED IN APRIL 1975

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Syllidae</b>				
<i>Brania wellfleetensis</i>			20	5
<i>Syllides</i> sp.			13	
<i>Syllis cornuta</i>				
undet. syllid				
<b>Hesionidae</b>				
<i>Microphthalmus szcelkowi</i>	183	42	294	2
<i>Microphthalmus</i> sp.				
<i>Podarmus</i> sp.			1	1
undet. hesionid				
<b>Pilargidae</b>				
<i>Sigambra bassi</i>			2	
<i>Sigambra tentaculata</i>				
<b>Nereidae</b>				
<i>Ceratonereis irritabilis</i>			2	3
<i>Nereis acuminata</i>			2	4
<i>Nereis pelagica</i>				
<i>Nereis succinea</i>				
<i>Rullierinereis mexicana</i>				
<i>Websterinereis glauca</i>				
undet. nereid				
<b>Capitellidae</b>				
<i>Capitella capitata</i>			1	2
<i>Dasybranchus lumbricoides</i>				
<i>Heteromastus filiformis</i>			7	49
<i>Mediomastus californiensis</i>			3	3
<i>Notomastus hemipodus</i>				2
<i>Notomastus latericeus</i>				
<i>Notomastus lunulatus</i>				
<i>Notomastus</i> sp.				
<i>Parheteromastus tenuis</i>				
undet. capitellid			1	
<b>Arenicolidae</b>				
<i>Arenicola cristata</i>				



## POLYCHAETES COLLECTED IN APRIL 1975

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Maldanidae</b>				
<i>Axiiothella mucosa</i>				
<i>Branchiosychis americana</i>				
<i>Clymenella mucosa</i>			13	22
undet. maldanid				
<b>Opheliidae</b>				
<i>Armandia agilis</i>			3	5
<i>Armandia maculata</i>	4	3	146	24
<i>Ophelia denticutata</i>			3	
<i>Travisia</i> sp.			16	84
<b>Spionidae</b>				
<i>Dispio uncinata</i>		1	5	
<i>Paraprionospio pinnata</i>			1	
<i>Polydora ciliata</i>				
<i>Polydora socialis</i>				
<i>Polydora tetrabranchia</i> (?)				
<i>Polydora websteri</i>				
<i>Polydora</i> sp.	6	1	29	35
<i>Polydorella prolifera</i>				
<i>Prionospio cirrifera</i>				
<i>Prionospio cristata</i>			30	86
<i>Prionospio ehlersi</i>				
<i>Prionospio malmgreni</i>				
<i>Prionospio pygmaea</i>			18	11
<i>Prionospio sexoculata</i>				
<i>Prionospio steenstrupi</i>				
<i>Prionospio</i> sp.				
<i>Pseudopolydora</i> sp.				
<i>Scoelelepis squamata</i>	16	7	11	
<i>Scoelelepis texana</i>			3	1
<i>Scoelelepis</i> sp.				
<i>Spio filicornis</i>				
<i>Spio pettiboneae</i>			29	9
<i>Spio</i> sp.				
<i>Spiophanes bombyx</i>	10	16	558	138
<i>Streblospio benedicti</i>				
<b>Paraonidae</b>				
<i>Aricidea fragilis</i>				
<i>Aricidea taylori</i>				1
<i>Aricidea</i> sp.				
<i>Paraonis fulgens</i>	47	35	31	1
undet. paraonid				



## POLYCHAETES COLLECTED IN APRIL 1975

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Chaetopteridae</b>				
Mesochaetopterus sp.				
Spiochaetopterus oculatus			1	1
<b>Onuphiidae</b>				
Diopatra cuprea				
Onuphis eremita	6		16	4
Onuphis magna				
<b>Lumbrineridae</b>				
Lumbrineris erecta				
Lumbrineris parvapedata				
Lumbrineris tenuis				
Lumbrineris tetraura				
Lumbrineris sp.			30	40
<b>Dorvilleidae</b>				
Dorvillea rudolphi				
<b>Amphinomidae</b>				
Eurythoe complanata				
Pseudeurythoe paucibranchiata			2	2
Pseudeurythoe sp.				1
undet. amphinomid				
<b>Euphrosinidae</b>				
Euphrosine triloba				
<b>Magelonidae</b>				
Magelona filiformis				
Magelona longicornis				4
Magelona pettiboneae	12			
Magelona riojai	187	17	672	66
Magelona sp.				



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POLYCHAETES COLLECTED IN APRIL 1975

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Orbiniidae				
Haploscoloplos foliosus				
Haploscoloplos fragilis				
Haploscoloplos robustus			1	
Naineris sp.				
Scoloplos fragilis			1	2
Scoloplos rubra				
Scoloplos sp.			1	
undet. orbiniid				
Cirratulidae				
Cirriformia grandis				
undet. cirratulid			12	24
Oweniidae				
Myriochele sp.			1	
Owenia fusiformis				
Pectinariidae				
Pectinaria gouldii			5	5
Ampharetidae				
Asabellides lineata				
Asabellides oculata	7		155	12
undet. ampharetid				
Terebellidae				
Loimia medusa				
Loimia viridis				
Sabellidae				
Chone dumeri				
Chone sp.				
Euchone sp.				
undet. sabellid				



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POLYCHAETES COLLECTED IN AUGUST 1975

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Phyllodocidae				
Eteone alba				
Eteone lactea				
Eulalia sanguinea			2	
Paranaitis speciosa				
Phyllodoce arenae		1	8	3
undet. phyllodocid				
Polynoidae				
Harmothoe lunulata				
Harmothoe sp.				
undet. polynoid				
Sigalionidae				
Sthenelais boa				
Eulepthidae				
Pareulepis fimbriata			5	
Glyceridae				
Glycera americana			4	
Glycera capitata				
Glycera convoluta				
Glycera dibranchiata				
Glycera oxycephala			2	
Glycera sp.				
Goniadidae				
Glycinde polygnatha				
Glycinde sp.				
Goniada littorea			3	
Nephtyidae				
Micronephtys sp.				
Nephtys bucera	39	4	37	8
Nephtys picta	48	5	271	53
Nephtys sp.				



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	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Syllidae</b>				
<i>Brania wellfleetensis</i>		3	230	11
<i>Syllides</i> sp.	2			
<i>Syllis cornuta</i>				
undet. syllid				
<b>Hesionidae</b>				
<i>Microphthalmus sczelkowi</i>	22	681	4	
<i>Microphthalmus</i> sp.				
<i>Podarmus</i> sp.				
undet. hesionid				
<b>Pilargidae</b>				
<i>Sigambra bassi</i>	4		65	
<i>Sigambra tentaculata</i>				
<b>Nereidae</b>				
<i>Ceratonereis irritabilis</i>				
<i>Nereis acuminata</i>				
<i>Nereis pelagica</i>				
<i>Nereis succinea</i>			5	
<i>Rullierinereis mexicana</i>			11	
<i>Websterinereis glauca</i>				
undet. nereid			1	
<b>Capitellidae</b>				
<i>Capitella capitata</i>				
<i>Dasybranchus lumbricoides</i>			7	
<i>Heteromastus filiformis</i>				
<i>Mediomastus californiensis</i>			1	
<i>Notomastus hemipodus</i>				
<i>Notomastus latericeus</i>			8	1
<i>Notomastus lunulatus</i>				
<i>Notomastus</i> sp.				
<i>Parheteromastus tenuis</i>				
<b>Arenicolidae</b>				
<i>Arenicola cristata</i>				



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POLYCHAETES COLLECTED IN AUGUST 1975

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Maldanidae</b>				
Axiiothella mucosa				
Branchiosychis americana				
Clymenella mucosa				
undet. maldanid				
<b>Opheliidae</b>				
Armandia agilis	19	2	6	1
Armandia maculata			7	
Ophelia denticutata			1	
Travisia sp.			34	3
<b>Spionidae</b>				
Dispio uncinata	11	3	27	4
Paraprionospio pinnata				
Polydora ciliata				
Polydora socialis				
Polydora tetrabanchia (?)				
Polydora websteri				
Polydora sp.		1	1	
Polydorella prolifera				
Prionospio cirrifera			10	
Prionospio cristata			6	
Prionospio ehlersi				
Prionospio malmgreni				
Prionospio pygmaea			19	
Prionospio sexoculata				
Prionospio steenstrupi				
Prionospio sp.				
Pseudopolydora sp.				
Scoelelepis squamata			2	
Scoelelepis texana				
Scoelelepis sp.				
Spio filicornis				
Spio pettiboneae	1			
Spio sp.				
Spiophanes bombyx	5	3	44	14
Streblospio benedicti				
<b>Paraonidae</b>				
Aricidea fragilis				
Aricidea taylori				
Aricidea sp.				
Paraonis fulgens	22	4		
undet. paraonid				



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POLYCHAETES COLLECTED IN AUGUST 1975

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
Chaetopteridae				
Mesochaetopterus sp.				
Spiochaetopterus oculatus				
Onuphiidae				
Diopatra cuprea			2	
Onuphis eremita	64	12	92	108
Onuphis magna				
Lumbrineridae				
Lumbrineris erecta				
Lumbrineris parvapedata			4	1
Lumbrineris tenuis				
Lumbrineris tetraura			2	
Lumbrineris sp.				
Dorvilleidae				
Dorvillea rudolphi				
Amphinomidae				
Eurythoe complanata			1	
Pseudeurythoe paucibranchiata			1	
Pseudeurythoe sp.				
undet. amphinomid				
Euphrosinidae				
Euphrosine triloba				
Magelonidae				
Magelona filiformis				
Magelona longicornis				
Magelona pettiboneae				
Magelona riojai	49	21	423	126
Magelona sp.				



## POLYCHAETES COLLECTED IN AUGUST 1975

	INLET INNER HABITAT	BEACH INNER HABITAT	INLET OUTER HABITAT	BEACH OUTER HABITAT
<b>Orbiniidae</b>				
Haploscoloplos foliosus	1	2		
Haploscoloplos fragilis				
Haploscoloplos robustus	1			
Naineris sp.			3	
Scoloplos fragilis	2		1	
Scoloplos rubra				
Scoloplos sp.	3			
undet. orbiniid			1	
<b>Cirratulidae</b>				
Cirriformia grandis				
undet. cirratulid			1	1
<b>Oweniidae</b>				
Myriochele sp.				
Owenia fusiformis				
<b>Pectinariidae</b>				
Pectinaria gouldii			1	
<b>Ampharetidae</b>				
Asabellides lineata				
Asabellides oculata			1	
undet. ampharetid				
<b>Terebellidae</b>				
Loimia medusa				
Loimia viridis				
<b>Sabellidae</b>				
Chone dumeri				
Chone sp.				
Euchone sp.				
undet. sabellid			27	3



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APPENDIX B  
PAC PREPARATION PROCEDURE



## APPENDIX B

## PAC PREPARATION PROCEDURE

## 1. HABITAT SAMPLING

Uniform sampling procedures should be used for any given locality. (It should be a goal of subsequent PAC studies to develop and recommend standard sampling procedures.) A uniform number of samples should be taken at each collecting station per sampling date. Samples should be promptly sieved, using a standard mesh size, and the polychaetes removed, stained with Rose Bengal, and preserved with 10 percent formalin-sea water solution.

## 2. PREPARATION OF STATION DATA FOR ONE SAMPLING PERIOD

a. Identify and count the number of individuals of each species (genus, family) of polychaetes in each plug sample. Combine these data for a given station and date, and prepare a list naming each species (genus, family) and giving the number of individuals of each in the pooled sample.

b. For the station and date, Species (genus, family) Richness is the total number of kinds of the appropriate taxon present in the pooled sample. Enter this on the list.

c. Given the known area of the pooled sample and the total number of individual polychaetes found in it, total density as individual worms per 1.0 metre<sup>2</sup> of sample may be calculated. Enter this on the list.

d. Diversity (Shannon-Wiener Diversity Index, H') is determined by the formula

$$H' = - \sum_{i=1}^s \frac{p_i}{N} \log_2 \frac{p_i}{N}$$

where s is the number of species (genus, families) and p<sub>i</sub> is the number of individuals belonging to species i, and N is the total number of individuals in the combined sample. Enter the diversity value on the list.



### 3. CALCULATIONS FOR THE HABITAT PAC

a. For a given location (habitat), place the lists for each sampling period (as described in 2 above) in a series of parallel columns, matching species (genus, family) names and counts, totals, richness, diversity, and density across the columns.

b. Calculate the average richness, density, and diversity of all of the sample periods combined. These constitute the community parameter values of the PAC. (Ranges, standard deviation, or other measure of variability may be calculated and entered as appropriate in the PAC.)

c. Determine the total number of individuals of each species (genus, family) present in all sampling periods combined. From this, calculate the percent of total individuals comprised by the individuals of each separate species (genus, family) (their frequency). All species (genera, families) with individuals comprising more than 2 percent of total individuals are presumptive major forms and are dealt with below.

d. For each presumptive major form, calculate the species (genus, family) abundance for each separate sampling period (i.e., for each column).

e. Major species (genera, families). If a presumptive major form is present in more than 50 percent of the sampling periods, then it is a major species (genus, family).

f. Dominant. If a major species (genus, family) has a total species frequency of 10 percent or more and has a frequency of 2 percent on more than two-thirds of the sampling dates, it is a dominant form.

g. Abundant. If a major species (genus, family) has a frequency of at least 2 percent on more than half of the sampling dates, it is an abundant form.

h. Common. If a major species (genus, family) has a frequency of at least 2 percent on half or fewer of the sampling dates, it is a common form.

### 4. PREPARATION OF THE HABITAT PAC

The habitat PAC is simply a list or table presenting the data calculated in paragraph 3 above in an uniform manner. This should include, in order: (a) Richness, (b) Density, (c) Diversity, and (d) Major Forms. The habitat PAC data may also include standard deviations or other measures of sample variation for the community parameter values.



